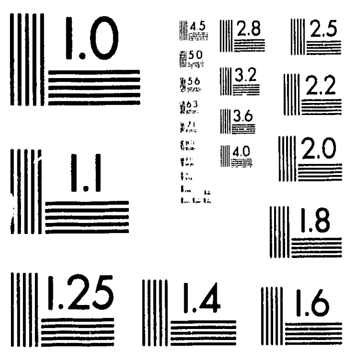
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OCT 06 1993 (11)
Station #12

ENGINEERING DATA TRANSMITTAL

1. EDT 600840

2. To: (Receiving Organization) Distribution	3. From: (Originating Organization) Geosciences	4. Related EDT No.: N/A
5. Proj./Prog./Dept./Div.: 200 West Area Carbon Tetrachloride Expedited Response Action	6. Cog. Engr.: V. J. Rohay	7. Purchase Order No.: N/A
8. Originator Remarks: Document for approval and release		9. Equip./Component No.: N/A
		10. System/Bldg./Facility: N/A
11. Receiver Remarks:		12. Major Assm. Dwg. No.: N/A
		13. Permit/Permit Application No.: N/A
		14. Required Response Date: October 4, 1993

15. DATA TRANSMITTED

(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	(F) Impact Level	(G) Reason for Transmittal	(H) Originator Disposition	(I) Receiver Disposition
1	WHC-SD-EN-TP-035		0	Tracer Gas Diffusion Sampling Test Plan	3Q	1,2	1	

16. KEY

Impact Level (F)	Reason for Transmittal (G)		Disposition (H) & (I)	
1, 2, 3, or 4 (see MRP 5.43)	1. Approval 2. Release 3. Information	4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION (See Impact Level for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.
1,6	/	Cog.Eng. *V.J. Rohay	VJ Rohay	9/30/93	H6-06	*L.M. Montgomery			H6-08	3	
1	/	Cog. Mgr. A.J. Knepp	AJ Knepp	9/30/93	H6-06	S.A. Driggers			H6-04	3	
1	/	QA R.L. Hand	R.L. Hand	10/1/93	H4-16	T.W. Spicer			N3-06	3	
		Safety				K.J. Swett			H6-06	3	
		Env.				B.G. Tuttle			N3-06	3	
6		*J.D. Fancher			N3-05	Central Files (2)			L8-04	3	
6		*B.J. Hobbs			N3-06	EPIC (2)			H6-08	3	
6		*M.A. Tredway			R3-54	ERC			H6-07	3	
						IRA (2)			H4-17	3	

18.	19.	20.	21. DOE APPROVAL (if required)
V. J. Rohay VJ Rohay 9/30/93 Signature of EDT Originator / Date	G. G. Henckel [signature] 10/1/93 Authorized Representative for Receiving Organization / Date	A. J. Knepp AJ Knepp 9/30/93 Cognizant/Project Engineer's Manager / Date	Ltr. No. [] Approved [] Approved w/comments [] Disapproved w/comments

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Date Received: 9/30/93 VB	INFORMATION RELEASE REQUEST	Reference: WHC-CM-3-4

Complete for all Types of Release

Purpose		ID Number (include revision, volume, etc.)
[] Speech or Presentation (Check only one suffix) [] Full Paper [] Summary [] Abstract [] Visual Aid [] Speakers Bureau [] Poster Session [] Videotape	[] Reference [X] Technical Report [] Thesis or Dissertation [] Manual [] Brochure/Flier [] Software/Database [] Controlled Document [] Other	WHC-SD-EN-TP-035, Rev. 0 List attachments. Date Release Required ~~July~~ September 28, 1993

Title: ~~Investigation of Soil Gas Diffusion and the Effects of Active Vapor Extraction~~ Tracer Gas Diffusion Sampling Test Plan	Unclassified Category UC- N/A	Impact Level 3Q

New or novel (patentable) subject matter? [X] No [] Yes If "Yes", has disclosure been submitted by WHC or other company? [] No [] Yes Disclosure No(s).	Information received from others in confidenc , such as proprietary data, trade secrets, and/or inventions? [X] No [] Yes (Identify)
Copyrights? [X] No [] Yes If "Yes", has written permission been granted? [] No [] Yes (Attach Permission)	Trademarks? [X] No [] Yes (Identify)

Complete for Speech or Presentation

Title of Conference or Meeting	Group or Society Sponsoring

Date(s) of Conference or Meeting	City/State	Will proceedings be published? [] Yes [] No Will material be handed out? [] Yes [] No

Title of Journal
N/A

CHECKLIST FOR SIGNATORIES

Review Required per WHC-CM-3-4	Yes	No	Reviewer - Signature Indicates Approval Name (printed)	Signature	Date
Classification/Unclassified Controlled Nuclear Information	[]	[X]			
Patent - General Counsel	[X]	[]	SW BERGLIN	SW Berglin	10/1/93
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RL Program/Project	[X]	[]	P. M. Pak	Paul M. Pak	9/28/93
Publication Services	[X]	[]	L. A. Brown	LABrown	10/5/93
Other Program/Project	[X]	~~[X]~~	G. C. Henckel III	G C Henckel	9/23/93

Information conforms to all applicable requirements. The above information is certified to be correct.

	Yes	No	INFORMATION RELEASE ADMINISTRATION APPROVAL STAMP
Referenc s Available to Intended Audience	[X]	[]	Stamp is required before release. Release is contingent upon resolution of mandatory comments.
Transmit to DOE-HQ/Office of Scientific and Technical Information	[X]	[]	APPROVED FOR RELEASE OFFICIAL IRS DATE 10/5/93
Auth r/Requestor (Printed/Signature)		Date	
V. J. Rohay Virginia J Rohay		9/22/93	
Intended Audience [] Internal [] Sponsor [X] External			
Responsible Manager (Printed/Signature)		Date	
A. J. Knepp A J Knepp		9/22/93	Date Cancelled / Date Disapproved

SUPPORTING DOCUMENT

1. Total Pages 8

2. Title	3. Number	4. Rev No.
Tracer Gas Diffusion Sampling Test Plan	WHC-SD-EN-TP-035	0

5. Key Words

active and passive vapor extraction, carbon tetrachloride

6. Author

Name: V. J. Rohay

Signature

Organization/Charge Code 81231/PU2BB

7. Abstract

APPROVED FOR PUBLIC RELEASE 10/5/93 D. Solis

WHC, 1993, *Tracer Gas Diffusion Sampling Test Plan*, WHC-SD-EN-TP-035, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

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CONTENTS

1.0 TEST OBJECTIVE AND SCOPE

Efforts are under way to employ active and passive vapor extraction to remove carbon tetrachloride from the soil in the 200 West Area on the Hanford Site as part of the 200 West Area Carbon Tetrachloride Expedited Response Action. In the active approach, a vacuum is applied to a well, which causes soil gas surrounding the well to be drawn up to the surface. The contaminated air is cleaned by passage through a granular activated carbon bed. There are questions concerning the radius of influence associated with application of the vacuum system and related uncertainties about the soil-gas diffusion rates with and without the vacuum system present. To address these questions, a series of tracer gas diffusion sampling tests is proposed in which an inert, nontoxic tracer gas, sulfur hexafluoride (SF_6), will be injected into a well, and the rates of SF_6 diffusion through the surrounding soil horizon will be measured by sampling in nearby wells. Tracer gas tests will be conducted at sites very near the active vacuum extraction system and also at sites beyond the radius of influence of the active vacuum system. In the passive vapor extraction approach, barometric pressure fluctuations cause soil gas to be drawn to the surface through the well. At the passive sites, the effects of barometric "pumping" due to changes in atmospheric pressure will be investigated. Application of tracer gas testing to both the active and passive vapor extraction methods is described in the wellfield enhancement work plan (Rohay and Cameron 1993).

2.0 DATA REQUIREMENTS

Required measurements for the two tracer gas release methods are given below, along with their associated accuracy and precision. Carbon tetrachloride concentrations will be measured as needed.

- SF_6 tracer release measurements:
  - concentrations (accuracy: ±10%, precision: ±5%)
  - release rate (accuracy: ±10%, precision: ±2%)

- Surface flux measurements:
  - flow rate (accuracy: ±10%, precision: ±2%)
  - concentrations (accuracy: ±10%, precision: ±5%).

These measurements will be recorded in field notebooks and then entered into appropriate computer spreadsheets for archival purposes and for further data analyses. Chromatograms from the chemical analyses will be recorded on paper using an electronic integrator and the printouts will be stored at Washington State University (WSU).

3.0 EQUIPMENT AND FACILITIES

3.1 WSU PROVIDED EQUIPMENT

WSU will provide the following:

- Varian 3600 gas chromatograph (Varian Associates, Walnut Creek, California) with thermal conductivity detector and electron capture detector. The electron capture detector contains a Ni^{63} foil in a sealed container with an activity of 8 mCi
- Surface flux chamber
- Flow regulation system
- Miscellaneous gas standards
- Miscellaneous fittings, tubing, etc.
- SF_6 tracer gas
- Calibration gas
- Zero air.

3.2 WHC PROVIDED EQUIPMENT

Westinghouse Hanford Company (WHC) will provide the following:

- Secure field laboratory space to set up and operate gas chromatograph
- Sufficient electricity to operate gas chromatograph
- Nitrogen
- Helium
- Compressed air (bottled).

4.0 TEST PROCEDURE

The experimental procedures will be relatively straightforward. For a given site, a specified amount of tracer gas will be injected into a well at a known depth, and the well will be packed and capped. In the initial tests, the tracer will be released at approximately 5 cm^3/min for 3 hours, which corresponds to a total release volume of 900 cm^3. For the active vapor extraction tests, this will involve selection of wells with openings at only one depth or the use of a well seal system to allow injection at a known depth. For the passive barometric pumping studies, the existing array of cone penetrometer points west of the 216-Z-1A tile field will be used where small-diameter tubing is already in place at selected depths. In both cases it will be important that the tracer release be at a single, known depth in order to use the subsequent tracer measurements for modeling purposes. This will be achieved through the use of packers and capping the well prior to release. Gas samples will be collected before and after the injection at periodic intervals from the injection well (to measure the decay rate of tracer) and from a series of wells or boreholes located at increasing distances from the injection well. The sampling interval will be hourly but can be increased (e.g., 15-minute intervals) to better characterize the tracer gas plume. The sampling system will consist of a pump and sampling line inserted into the hole at a known depth. Stainless steel canisters, designed for whole air ambient sampling, or polyethylene syringes will be used to collect air samples withdrawn from the wells. For the canister samples, a sampling volume in the range of 1 to 3 L will be extracted. Syringe volumes will be less than 60 cm^3. In either case, air will be passed through high-efficiency particulate air (HEPA) filters to avoid contamination problems. At the vapor extraction site, tracer tests will be used to define the radius of influence of the vacuum system. This will be done by repeating tracer injection experiments at progressively farther distances from the vacuum extraction well. For these experiments, air samples will be collected from the vapor extraction gas stream and from other wells surrounding the tracer injection well.

Wind speed, direction, temperature, pressure, and humidity will be measured continuously with the existing weather system located at the 216-Z-1A tile field. Soil temperature data will be acquired from the Hanford Meteorological Station.

The success of the experimental tests will be determined in terms of successful detection and monitoring of tracer gas concentrations at the various sampling locations so that the pattern of gas diffusion can be determined. In addition to being able to identify gas diffusion patterns, successful tests will require sufficient measurements to yield gas diffusion rates over the source-receptor distances involved.

5.0 QUALITY ASSURANCE TASKS

The primary experimental measurements will involve measurement of tracer release rates, collection of gas samples, and analysis of these samples for SF_6 tracer gas and, in some cases, soil-gas contaminants (primarily carbon tetrachloride). The tracer release system will involve the use of mass flow meters and/or rotameters. Both systems will be calibrated prior to the measurement period using a wet test meter with nitrogen gas set at a series of flow rates covering the range from 5 mL/min to 500 mL/min. In addition, a dry gas meter will be used to obtain simultaneous, independent measurements of the tracer release rate. The performance of the release system will be monitored during each test, and the release rates determined from the mass flow and dry gas meters will be determined immediately following each test to identify potential problems with any part of the release system.

During each tracer test, duplicate samples will be collected on a routine basis (i.e., 1 duplicate per 10 samples) for quality assurance (QA) purposes. This will involve collection of two samples either simultaneously from a sampling manifold or in quick succession from a single sampling line. Sample blanks will be included by filling a canister with zero air and transporting the canister with the normal samples during an experiment. A sample blank will be tested for each 20 samples. Canisters will be cleaned prior to each field period by evacuation to a vacuum and then purging with moist zero air at 60 °C overnight. The zero air will be generated using an Aadco Zero Air Generating System (Aadco, Inc., Rockville, Maryland). The canisters will be slightly pressurized with moist zero air for transport from WSU to the field site. Syringes used for sampling will be purchased for this project and used only once. Blanks will be checked by filling the syringes from commercial zero air cylinders (Scott-Marrin, Inc., Riverside, California) for subsequent analysis.

The electron capture gas chromatograph will be calibrated immediately prior to each analysis period using a series of SF_6/air mixtures certified at ±5% accuracy (Scott-Marrin, Inc., Riverside, California). In past tracer studies (Guenther et al. 1989, Allwine et al. 1992), calibration gases were selected to cover the concentration range from 25 parts per trillion (ppt) to 10 parts per billion (ppb) (typically 30 ppt, 300 ppt, 1,000 ppt, 3,000 ppt, and 10,000 ppt). In this study, it may be necessary to enlarge this range to parts-per-million levels. This will require obtaining additional standards at higher concentrations and possibly using the thermal conductivity detector at the highest concentration limits. The calibration procedure, using syringe aliquots taken from the SF6/air standard gas cylinders, will be the same as used in past WSU tracer studies (Guenther et al. 1989, Allwine et al. 1992). Span gas checks using the calibration gases will be made on an hourly basis during each analytical period, and sample reanalyses will be completed for approximately 10% of the samples. Similar calibration mixtures of carbon tetrachloride in nitrogen will be used to calibrate the thermal conductivity gas chromatograph. In this case, the concentration range will extend from approximately 10 parts per million (ppm) to 1,000 ppm. The thermal conductivity gas chromatograph will be calibrated immediately prior to each analytical period, and span checks and sample reanalyses will be conducted as described above.

All of the appropriate release and sampling information will be manually recorded in a field notebook. The samples will be clearly labeled with a unique ID number along with the test number, date, time, and location, which will also be recorded in the sampling notebook. This ID number will be used to identify the analysis, and the results will be recorded manually in an analysis notebook. The information in the notebooks will be photocopied for archival purposes after each field period.

6.0 ORGANIZATION AND FUNCTION RESPONSIBILITIES

WHC will be the primary operating organization. WHC will provide a field team leader to supervise field operations. Field operations will be supported by WHC and will include connection of tracer gas cylinders to injection points and collection of gas samples from wellheads and the vapor extraction system. WHC will provide health and safety and health physics oversight.

WSU will be a support organization. WSU will provide all special equipment described in Section 3.1. WSU will provide all GC analysis and perform data reduction. WSU will prepare all reports listed in Section 8.0 (with WHC review).

7.0 SCHEDULE

It is anticipated that each tracer injection and sampling test will occur over approximately a 2-week period. Initially, it is planned to conduct two experiments at passive sites and two experiments at active extraction sites. Following completion of the initial, intensive sampling period, a site(s) will be selected for longer term sampling in order to monitor the continued diffusion of the tracer gas. This extended monitoring program will be useful for investigating barometric pumping effects upon soil-gas diffusion rates in the vicinity of wells.

The schedule for this work will encompass 1 year. With a starting date of August 27, 1993, preparations will begin immediately to finalize the experimental design so that the initial tests can begin during the early fall of 1993. Field work will continue during the fall and extend into the spring. Data reduction and analysis will begin as soon as sampling results are obtained so that initial results can be used to guide later field measurements. Final analysis and presentation of the results will be completed during the late spring and summer.

8.0 REPORTS AND PUBLICATIONS

Quarterly progress reports describing interim test results will be submitted to WHC. The final report describing all the data and analysis will be completed in the form of a manuscript suitable for publication in a peer-reviewed scientific journal within 90 days of the final field test and submitted to WHC. WSU will also provide copies of all data on disk in Quattro Pro (Borland International, Inc., Scotts Valley, California) or equivalent format.

9.0 SAFETY

All aspects of the measurement program will be conducted using WHC safety procedures. High-pressure gas cylinders will be secured at all times. This work does not involve the handling of any hazardous waste or radiological materials.

10.0 REFERENCES

Allwine, K. J., B. Lamb, and R. Eskridge ,1992, "Wintertime Dispersion in a Mountainous Basin at Roanoke, Virginia: Tracer Study," *J. Appl. Meteor. 31*, 1295-1311.

Guenther, A., B. Lamb, and E. Allwine, 1989, "Building Wake Dispersion at an Arctic Industrial Site: Field Tracer Observations and Plume Model Evaluations," *Atmos. Environ.*, *24A*, 2329-2347.

Rohay, V.J., and R.J. Cameron, 1993, *FY 93 Wellfield Enhancement Workplan for the Carbon Tetrachloride Expedited Response Action*, WHC-SD-EN-AP-114, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

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